


Entry probe stability analysis for the Mars pathfinder and the Mars-Premier orbiter

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Computational fluid dynamics is a very precious tool for the prediction of the aero- thermal environment of entry vehicles. For the pathfinder project, in-depth studies and rebuilding of the static instabilities have been carried out (see ref [1]). In particular stable and critically stable cases have been identified.

In the present paper, a first case will focus on the pathfinder geometry (see figure 1) with the study of a stable case to compare with existing results published in the literature. Then a critically stable case is to be studied with several chemistry sets to see how the chemistry reactions can affect the results from the stability view point (two 5 species mars atmosphere model and one 8 species model).

Following this study, a different probe shape is to be used, namely the orbiter defined within the CNES led Mars-Premier project and shown in figure 2. Using CFD for several trajectory points, the stability of the body will be evaluated to try to identify unstable cases and see how the shape (nose radius, cone opening angle) relates to the stability issues.

Figure 1: Pathfinder shape

Figure 2: MSRO Mars-Premier shape

...FIGURES....[see pdf abstract](#)

References: 1. "Prediction and Validation of Mars Pathfinder Hypersonic Aerodynamic database", Peter A. Gnoffo, Robert D. Braun, K. James, Robert A. Micheltree, Walter C. Engelund, Richard W. Powell, AIAA 98-2445 - 7th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, June 15-18 1998 Albuquerque, NM